UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH**

MARCH 1949

EROSION CONTROL PRACTICES DIVISION

Soil Compaction in Relation to Infiltration - Earle D. Matthews, Morgantown, W. Va.-"Preliminary greenhouse work on soil compaction, as reported for January, has been a failure due to inability to get stands of red clover. However, the experiment has been re-started, using Sudan grass as an indicator crop, and results to date are satisfactory. The following mean results, comparing degree of compactness and infiltration, have been obtained (average 4 replications):

Volume Weight	Infiltration in./hr.
1.18	14.34
1.41	.60
1.26	3.38
1.56	.12

"The soil is Rayne silt loam. While plant measurements including root distribution are yet to be made, it has been observed that the poorest stand and least top growth to date (2 weeks from seeding) has been at volume weight 1.18. This is probably due to some desiccation of soil between additions of water. These additions have been uniform for all treatments. It will be interesting to note whether top growth at very low volume weight will continue to be small after root systems have had further chance to develop.

"A very good lineal relationship exists between the values given above when volume weights are plotted as ordinates and infiltration as abscissae on semi-log paper. Replicates show very good agreement, except at the lowest volume weights.

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** All research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

Summary of Soil Conservation Research Need in West Virginia - "Considerable time has been spent in February and March assembling and summarizing the ideas and opinions of many concerning the role of SCS research in West Virginia. Most of the remainder of this report will be devoted to this subject. The items listed below are the results of the combined ideas and suggestions of experiment station and extension workers, the project supervisor, and particularly SCS operations men in West Virginia. Titles vary from the specific to the general. Those investigations considered to be the most important will be so indicated. All are tentatively given in line project number simply for purposes of classification. Proposals for the execution of which the services of an engineer would be either desirable or necessary will be marked by an asterisk (*).

R-1-1-2 - *What are minimum and maximum effective widths of contour strips, and maximum slopes practical for contour strips on selected soil types and erosion conditions?

R-1-1-3 - Determine methods of establishing a rotation on a series of strips on small farms in a minimum length of time without sacrificing the corn-wheat-hay-corn sequence.

Improvement of rotation of row crop with 3 or more years of hay with emphasis on time and method of seeding grass and on elimination of corn stubble.

R-1-1-4 - Methods of renovating strip mine areas, with particular reference to cost and economic feasibility; study of mulching these areas suggested.

What are the minimum and maximum intervals between contour furrows and maximum slopes practical for contour furrows, on selected soil types and erosion conditions?

It is felt by many that LUC tables are based too much on common practice. Therefore, based on research, what are the maximum slopes that can be economically maintained in pasture? Some feel that slope limits of Class VI are either too high or too low in many instances; same applies to cropland in Class IV (Partially in R-1-3-2).

R-1-1-6 - What is the value of fencing, without planting, of badly eroded areas? Some feel that in this manner protective cover can be developed naturally and rapidly and at much lower cost than with present practice.

R-1-2-2 - IMPORTANT. In view of the interest in farm ponds, what are the water relationships of various soil materials as fills and floors for such ponds? Present practice in the field is largely guess-work.

VERY IMPORTANT. What are the water holding capacities of various forest soils as related to previous cutting practices, burning, etc. To quote R. K. Ziebarth "our problem is more and more one of water conservation and (I am convinced) that water shortages and floods will be of (critical) importance long before food shortages will be. In this state there are 10,000,000 acres of some type of forest cover and the general concensus of opinion is that it should remain so. However, there is a vast difference in water-holding capacity of these 10,000,000 acres. Since two-thirds of the water that falls on the State is affected by this woodland cover, it seems to me that we should know more about what

might be done to increase its water holding capacity.....What are the best practices that might be used to speed up the accumulation of surface litter which presumably will aid in retaining rainfall? This is no doubt a long time project but it would seem that something should be done toward making a start to find the answer."

R-1-2-4 - IMPORTANT. What are the effects of drainage on important soil characteristics such as aggregation, permeability, redox potential, etc.? (This study already under approved working plan).

IMPORTANT. What are the interrelations of gaseous permeability of the soil with other soil characteristics with reference to erodibility and land use?

R-1-2-6 -. IMPORTANT. A study of the structure-producing characteristics of certain crops.

R-1-3-1* - Effects of intensity and recurrence of frost on soil characteristics that influence erodibility and land use.

R-1-3-2* - Effects of mass movements of the soil mantle on land use characteristics of the Appalachain Plateau.

R-1-4-1 - What are the most suitable hay and pasture plants for wet lands difficult or impossible to adequately drain because of position and/or extremely impermeable and shallow subsoils (also R-1-6-2).

The physical characteristics of the soil in relation to stand, yield, and longevity of alfalfa.

R-1-4-2 - What is the natural succession on strip-mined areas, and how rapidly can we expect natural control?

R-1-4-3 - On poorer strip-mined areas, are we justified in making recommendations to restore cover similar to original? Is any cover economically justified? If so, what specific cover type should be recommended and how can it be feasibly established?

R-1-6-1 - What are conditions under which establishment of new woodland by natural vegetation is feasible? How long, under these conditions, may it be before erosion control is established on specified slopes, soils, and erosion conditions?

Same problem, but by artificial planting of white and/or red pine.

R-1-6-2 - Can alfalfa be adapted to imperfectly drained soils such as Ernest and Tilsit? If so, what seeding recommendations?

Are fescues (particularly Kentucky 31) valuable and suitable for areas more or less inaccessible for intensive treatments?

Needed are tests of varieties and strains of brome grass and brome grass seeding mixtures.

Does Buffalo alfalfa have any place in permanent hay and pasture mixtures?

Is there a suitable grass or mixture for worn-out cropped fields which the farmer cannot afford to treat adequately? (We doubt it, except perhaps for deer-tongue grass under specific conditions.)

IMPORTANT. All of the above in R-1-6-2 might be summarized as "erosion control characteristics and economic value of certain grasses and legumes."

R-1-7-1* - Is there an effective means of controlling runoff where diversions are needed but no suitable outlet can be found? This is of special importance where otherwise good land cannot be kept in pasture or forest but must be sometimes cultivated (farmer's viewpoint).

R-1-7-2* - IMPORTANT. Development of specialized farm equipment for hillside farming, with emphasis on determination of critical values of slope and roughness of terrain above which use of any equipment is non-economic.

*IMPORTANT. Study of machines (other than discs) adaptable to rough slopes up to 40% for renovation and reseeding pastures and long-term hays.

*What are the best means of puddling bottoms for farm pond construction?

*VERY IMPORTANT. A study of mechanical soil treatments to increase infiltration of critical land use areas during periods of excessive or intense precipitation.

R-1-8-1 - VERY IMPORTANT. The economics of conservation farming on individual farms in West Virginia. Specifically, is grass-land farming under approved conservation measures economically feasible? And how does it compare economically with "conventional" or rotation farming under West Virginia conditions?

R-2-1-1 -*VERY IMPORTANT. What are specific recommendations for drainage (chiefly on Atkins silt loam) as to feasibility, depth, spcaing, and grade, with tile drains compared to open drains? Should open drains have supplementary lateral tile drains? What are the economics of such drainage?

*IMPORTANT. On wet lands with practically impermeable layers at 12 to 18 inches, what are recommendations for depth, spacing, etc. of tile drains? What is the most economic use of such land when drained?

*Is open ditch drainage effective and sufficient for meadow and pasture?

R-2-1-2 - *What is the effective depth, etc. of using dynamite in spot-blasting of wet spots in fields?

R-2-8-1 - *IMPORTANT. What are the best methods of temporary irrigation for grasslands for summer production of pasture and hay, on uplands and on bottoms and terraces?

*IMPORTANT. A design and method of use of portable irrigation equipment is requested by operations men and others.

R-2-8-2 - *IMPORTANT. Determination of the economics (cost and potential value) of portable and permanent irrigation facilities particularly for pastures and forage crops.

"It is realized that there is current information on some of the above posed problems. Also, we received inquiries and requests for information and research on subjects (particularly fertility) not covered in the scope and limitations of SCS research. Where possible, we will supply information, or refer to other agencies.

"In view of the fact that many of these problems involve factors beyond the capabilities of the project supervisor (particularly engineering, drainage, irrigation, and economics) we are sending copies of this report to additional interested parties. We would particularly value comment by Mr. Jones on drainage and irrigation problems, and by Mr. Bell on other phases of engineering and upon economic studies."

Using the Rotary Subsoiler to Control Small Gullies - Maurice Donnelly, Riverside, California.-"Introduced into southern California by Service technicians of the Portland office, the rotary subsoiler was first regarded as a substitute for the heavy, chiseling tool called the subsoiler. In the regular subsoiler the blade is fixed. In the rotary subsoiler the slightly curved blade is carried on a strong block that rotates on an axle. Four blades spaced 90 degrees apart are fixed to one block. Several blocks are carried on a single axle. Penetration of the rotary subsoiler blade into the soil depends on (1) the hardness of the soil, (2) the weight of the machine and load, and (3) the curvature of the blade.

"It has been found that on a thoroughly dry soil, likely to be encountered in grain culture in the early fall, the rotary subsoiler blade will not penetrate deeply enough. After the soil has been softened by rains, however, penetration is quite satisfactory. In a somewhat converse manner, it has been found that regular subsoiling is useful only if the soil is dry and hard. After the soil has been softened by rains, regular subsoiling gives little benefit. Hence it appears that in this zone, at least, the rotary subsoiler and the regular subsoiler are not adapted to the same kind of work.

"The action of the rotary subsoiler is to leave small pits or holes in the ground. In this respect it resembles the eccentric disk. One remarkable feature is found on rotary subsoiled land that insofar as I know is unique. Technically stated, this feature is the isotropic distribution of the disturbance of the soil. In other words, the rotary subsoiler may be pulled over sloping land in any direction without leaving marks or lines over which water may run downhill.

"This isotropic feature of rotary subsoiling was used to good effect in a field trial of the control of small gullies. These small gullies are a common problem in annual cropping and heretofore there has been no economical way to handle the problem. The procedure in this field trial was to spread a small quantity of straw in and near the little gully. Barley was scattered over the surface to be treated at a rate of 100 pounds per acre. The gullied area and the land on either side of it for a distance of about ten feet was then rotary subsoiled.

"While rainfall of the season thus far was not enough to give the trial a thorough test, the results seen are promising enough to warrant further trials. It should be remembered that in this application, however, the rotary subsoiler is limited to treatments of small gullies in which the blades can penetrate below the bottom of the gully channel."

Winter Runoff and Erosion in Relation to Strip Cropping - O. E. Hays, LaCrosse, Wisconsin.-"During January and February warm temperatures were experienced which resulted in the loss of a considerable portion of the snow without much thawing of the soil. As a result soil losses were so low that samples of the runoff were not taken. It is interesting to note that runoff from hay and grass plots has been higher than from plowed hay and corn land. It will be noted that in the table of runoff the difference between plowed and hay land was greater during the first runoff periods and decreased thereafter.

"It appears that the plowed soil is able to absorb considerable runoff even though frozen whereas the hay and grass land remain unabsorptive until completely thawed.

Winter Runoff from Control Plots

Date 1949		Plot 4 Corn	Plot 5 Grain	Plot 6 Hay	Plot 7 Hay
1/4-5	Rain and thaw	.04	.03	.27	.35
1/7-8	Rain and thaw	0	0	.11	.07
1/15	Thaw	.05	.06	.91	.66
2/18-19	Thaw	.02	.07	.08	.05
2/23-25	Thaw	.51	.54	.56	.50
2/25-26	Thaw	.02	.08	.09	.05
Total		0.64	0.78	2.02	1.68

"This winter runoff as influenced by crop points out a pronounced weakness of strip cropping. With alternate strips of plowed land and hay, the runoff from the hay flowing across bare, partially thawed plowed land has resulted in high soil losses. The protection in the summer thus becomes the cause of trouble in the winter. Certainly where alternate freezing periods are frequent, strip cropping would not be a very effective erosion control system.

"Terraces were filled with ice during these thaw periods and in many cases overtopped. Water flowing on top of snow froze, resulting in a greatly reduced channel capacity. The damage, however, was slight as the runoff came slow. On some of the terraces at the Station the tractor was used to free the channel of snow and ice. One of the causes of trouble was the variation in thawing of snow in the channel due to variations in facing and to protection from woods. The south-facing slopes thawed during the afternoon whereas the slopes facing other directions did not. Runoff flowing from a south-facing slope would freeze and cause over-topping when the terrace continued on some other facing slope."

Erosion Loss was Heavy on Bare Ground in January - Thomas N. Jones, State College, Mississippi.-"The total rainfall for January was 13.85 inches. This is the highest rainfall for the month of January that this Station has ever recorded in its 60 years of rainfall records. During the first five days of January, we received 7.90 inches of rain. The greater part of this rain was received on January 3 and 4, in which time we received 6.78 inches. The sixty year average rainfall for January is 4.88 inches. Soil and water losses are shown in Table I.

"Total rainfall recorded at State College, Mississippi for the month of March was 5.84 inches. The 60 year average rainfall for March is 6.20 inches. Soil and water losses are shown in table II.

Table 1.--Runoff and soil loss on bare plot during month of January 1949

January	Rainfall	Percent Runoff	Soil Loss Per Acre
2 3	0.07)-- 4.02)	82.0	19,356
4 5	2.76) 1.25)--	69.0	11,468
17	1.80	94.4	1,992
18	0.42	100.0	2,024
21 22 23	1.86) 0.51)-- 0.01)	100.0	3,212
26	0.25		
27	0.05		
30	*0.85		
		Total	38,052 Lbs.

* Sleet and snow measured as water.

Table 2.--Runoff and soil loss on bare plots during March 1949

March	Rainfall	Percent Runoff	Pounds Soil Loss
6	0.38	No Loss	
9	0.50	No Loss	
13	0.03	No Loss	
14	0.02	No Loss	
18	0.14	No Loss	
21	0.57)	20.4	3,700
22	1.06)		
25	0.85	19.0	1,344
27	0.85)	14.6	6,948
28	0.25)		
30	0.66)	18.0	5,588
31	0.53)		
Total	5.84		17,580

Value of Terraces in Reducing Runoff and Topsoil Loss - D. D. Smith, Columbia, Mo.-"Terracing has been very effective in reducing peak runoff rates from cultivated fields. While the reduction has been greatest for the more frequent intensity storms, it has been of significant magnitude for storms of flood-producing potentiality. This is shown by analysis of runoff records from the Soil Conservation Experiment Station, Bethany, Missouri (now discontinued). The soil was Shelby loam of slow to moderate permeability, similar in this respect to much of the cultivated soil in Missouri. The percentages reduction in peak rates were as follows:

Recurrence Interval One year in -	Relative peak rate reduction by terracing on area of 8 acres.
50 years	35%
25 years	37%
10 years	41%
5 years	46%
2 years	60%

"Unfortunately, similar data are not available for areas greater than 8 acres. It is logical to expect that the percent reduction would decrease as the drainage area increases. Whether the reduction from terracing would extend to areas of sufficient size to be effective in reducing flash flood runoff has not been established from experimental studies.

"In the Bethany study the watershed which was not terraced started with an average of 10 inches top soil. This was two inches more than for the terraced watershed. After 11 years of farming, the average topsoil depth for both was about equal (8 inches). Both areas were farmed to a 4-year rotation including one year of grass-legume meadow.

Ladino Clover Resists Frost Heaving on Claypan Soils Compared with Other Legumes - Mr. Whitt reports: Very marked differences in heaving damage to legumes were observed on March 24. Damage was most severe in legumes with tap roots--sweet clover and alfalfa. On relatively flat areas, 4 to 6 inches of the tap root was showing. Less heaving occurred where the surface litter was heavy and on land with slopes of 3% or more. Sweet clover broadcast in corn last year had heaved completely out of the ground and was dead. The greatest contrast was in a field where Ladino, Red, and Alsike clovers were seeded together. Red and Alsike had heaved 2 to 3 inches, but little or no heaving of Ladino was observed. Ladino clover, with its stolons and fibrous root system, appears well adapted to soils such as these claypans where heaving is a problem. Birdsfoot trefoil was severely damaged by heaving. Heaving was as severe this year as any in the memory of local farmers."

Grazing and Utilization Results from the Pitted and Non-Pitted Native Range Started in 1942 - O. K. Barnes, Laramie, Wyoming.-"During 1948 the two pitted pastures carried 38 percent more sheep than the two non-pitted pastures and produced 8.1 pounds greater lamb gain per acre. At the end of the grazing season the pitted pastures had approximately 20 percent more grass left than did the non-pitted pastures.

"Over the seven-year period since these pastures were pitted, they have carried an average of 33 percent more sheep, 37 percent or 10.9 pounds more lamb gain per acre with an average of 43 percent more grass left each year than the two adjoining non-pitted pastures.

"By coincidence an interesting comparison has developed between the above group of pastures and an adjoining group used for the rate of grazing study. This latter study started in 1944 with three rates of forage removal each year. The two pastures used at the heavy rate by chance have an average stocking rate approximately equal to that on the two pitted pastures. These pastures are comparable in topography, soils and original vegetation. The grazing and utilization results from 1944 through 1948 are as follows:

	Sheep Days Per Acre	Lamb Gain Per Acre	Lamb Gain Per Head	Ave. Lbs. Grass Left per Acre at End of Grazing Season
Pitted Pastures	81	38.8	49.6	359 lbs.
Heavy grazed pastures	86	36.7	45.3	94 lbs.

"The significant point in this comparison is the difference in volume of grass left at the end of the grazing season on these two groups of pastures under similar rates of use. It will be interesting to note the effects on gains and vegetation in the future of this continued difference in carry over grass each year.

Year	Sheep Days Per Acre (days)		Lamb Gain Per Acre (Lbs.)		Lamb Gain Per Head (Lbs.)		Grass Left Per Acre (Lbs.)	
	Pitted	Check	Pitted	Check	Pitted	Check	Pitted	Check
1942	71	71	32.0	27.9	37.4	34.6	425	442
1943	86	69	56.4	42.9	62.3	56.9	446	293
1944	92	59	47.3	28.2	38.5	36.0	429	219
1945	86	61	43.6	32.1	58.1	54.9	437	237
1946	66	46	30.0	20.8	50.4	52.0	269	166
1947	95	70	39.9	29.2	57.3	54.7	Records Incomplete	
1948	68	49	33.3	25.2	43.6	47.3	299	251
Ave.	81	61	40.4	29.5	49.7	48.1	384	268

Dust Bowl Studies - H. H. Finnell, Goodwell, Oklahoma.-"The final revisions of two manuscripts scheduled for publication this spring were accomplished during the month of March. These are tentatively titled 'Land Use Experience in Southern Great Plains' and 'Dust Storms Come from the Poorer Lands.'

"A final early spring field inspection trip was made during the month to include the east part of the Texas Panhandle and western Oklahoma. An account of these observations may be found in my semi-monthly report to the Chief on dust bowl conditions.

"A few points of interest showing up in the erosion and moisture data for southern Great Plains wheat lands during the four-year period 1945-48, inclusive, may be noted:

"The average wheat yields were 17.2 bushels per acre on the basis of sowed acreage, compared with 6.5 bushels per acre during the 1938-39 period, previously studied. Removals by wind and water erosion from wheat lands during the 10-year period between 1936 and 1946 were 11.5% of the total erosion removals recorded on these lands since they were put in cultivation. One apparent contrast between the seasonal conditions of these two periods is the average amount of January to May rainfall representing the spring growing season on winter wheat. For 1938-39 it averaged 4.89 inches, for 1945-48 it was 5.86. One expected difference already showing up is the relative minor importance of moisture variations during periods of plentiful moisture supply. This is expected to give us an opportunity of getting a better measure of the effects of soil and erosion variables."

Contouring Effective with Corn and Soybeans at Urbana, Illinois - C. A. Van Doren.-"Contouring was unusually effective on the contour farming plots at the Agronomy Farm during the 1948 calendar year. Soybeans continued to provide more effective protection to the soil against erosion on both non-contoured and contoured plots. Soil and water losses are reported in the following table:

Effect of Contour Farming on Soil and Water Losses - 1948

	Corn		Soybeans	
	Up & Down	Contour	Up & Down	Contour
Soil loss, lbs. per acre	10,457	2,393	6,451	1,081
Water loss, inches	3.94	1.94	3.56	0.88

Rainfall: March, 2.09".

Soil Moisture and Nitrate-Nitrogen in Relation to Stubble Mulch Management of Wheat Land - C. J. Whitfield, Amarillo, Texas.-"Soils on the stubble mulch plots were sampled to a depth of four feet on March 18 for the purpose of making soil moisture and nitrate determinations. Results of the studies clearly demonstrated the effectiveness of the stubble mulch system of cultivation in storing winter moisture. Soil moisture samples taken at an earlier date, on October 10, 1948 had revealed that on both the continuous wheat plots and on the fallow plots from which wheat had been harvested in 1948, there was, if any noteworthy differences existed, slightly less moisture where the subtillage sweep machine had been used as the method of cultivation than where the oneway or moldboard plow was the tillage implement. On land in fallow during the summer of 1948, however, the moisture studies showed that more rainfall had been stored on subtilled than on onewayed land.

"On March 18, 1949 it was found that the subtilled plots now in fallow contained about 15 percent more soil moisture than the onewayed fallow plots and had therefore more than overcome the moisture disadvantage which had existed the previous fall. The method of tillage had little influence on the amount of available nitrogen. On the wheat fallow plots now in wheat, the subtilled plots contained about 10 percent more soil moisture than the onewayed plots but had a distinctly smaller amount of nitrates, the inferiority amounting to from 17 to 50 percent.

"On the continuous wheat plots, the onewayed plots were notably lower in soil moisture than the plots cultivated by subtillage or by using the moldboard plow. The onewayed plots, however, had the highest nitrate content. The subtilled plots had the highest moisture content and the lowest nitrate content.

"It has been noted in previous years that the higher yields of wheat obtained under subtillage as compared to other methods of tillage are accompanied by lower straw-to-grain ratios. It has been proposed as an explanation of this relationship that the subtilled plots produce less nitrates early in the spring, thereby avoiding over-stimulation and an excessive early spring growth with the result that the crop becomes less impoverished of moisture as harvest time approaches and makes a more efficient use, as far as grain production is concerned, of the rainfall. Precipitation is usually the limiting factor in grain production in the Amarillo area.

"A spotted condition of the wheat fields in this area with dark green areas interspersed with chlorotic ones, has been noticeable during March. Such a condition is commonly attributed to a nitrogen deficiency. Soils from the top foot of two such representative areas were sampled and were found to both be very low in nitrates (2-3 p.p.m.) but not to differ greatly in nitrate content. The soil of the yellowish-wheat area, however, was very wet below the top six inches, while the soil in which the dark-green wheat was growing was considerably drier. The logical explanation is that wheat in both areas was exhausting soil nitrates to about the same level, but that the dark green wheat was being fed somewhat better, due to more favorable conditions for nitrification in the warmer, better aerated, soil. These facts are in agreement with observations made on the stubble mulch plots where the subtilled plots were found to be high in moisture but low in nitrates. None of the stubble mulch plots, however, have shown visible nitrogen-deficiency symptoms although the mean nitrate-nitrogen content of the subtilled plots in continuous wheat was but four parts per million in the top foot of soil. Chlorotic areas are invariably associated with depressions in the fields."

Conservation Rotations Increase the Efficiency of Applied Fertilizers with Respect to Cotton Yields - B. H. Hendrickson, Watkinsville, Ga.-"The following table based on the 5-year average 1944-48, gives the pounds of seed cotton produced in 5 rotations on Cecil soil, Class II and III land, per pound of applied N:

Rotations	Class of Land II	III
Continuous Cotton	21.4	19.4
2-Year Rotation No. 10:		
(1) Cotton-Vetch	24.5	23.5
(2) Corn ⁄ Crotalaria		
4-Year Rotation No. 20:		
(1) Oats (seed) - Kobe lespedeza (seed)		
(2) Kobe lespedeza (hay)		
(3) Cotton - Vetch	27.2	24.9
(4) Corn - Oats		
3-Year Rotation No. 14:		
(1) Oats (seed) - Kobe lespedeza (seed)		
(2) Kobe lespedeza (hay)	-	26.4
(3) Cotton - Oats		
4-Year Rotation No. 28:		
(1) Oats ⁄ Caley peas (seed) - Kobe lespedeza (seed)-Caley peas		
(2) Caley peas(hay)-Kobe lesp.(hay)-Caley peas		
(3) Caley peas (green manure)-Corn⁄Crotalaria - Caley peas		
(4) Caley peas (green manure)-Cotton - Oats ⁄ Caley peas		26.8

"All of the cotton received 500 pounds per acre 6-8-6 + 100 pounds per acre nitrate of soda. One ton per acre of dolomitic limestone was applied every 5 years. The average yield of seed cotton may be determined by multiplying the above figures by 46, which is the total pounds of N applied.

Upland Winter Pastures-"Cage clippings taken from 3 of our best pastures on December 28 and March 2, produced a total of from 1.70 to 1.95 tons per acre of dry herbage. This represents the bulk of the winter grazing provided during the past mild winter by our best winter grazing crops, as the oats, ryegrass and crimson and bur clover combinations, on eroded upland fields. (Two tons of hay are considered a good yield for summer hay crops). In addition, the flush spring grazing period for these same winter grazing crops is now in full swing, with another ton or more per acre of herbage in sight, until pastures are closed to permit seed maturity for combining and reseeding of most of the crops used.

"The following conditions apply to the best-producing winter upland pastures; all received disc-harrow early preparation, complete fertilizer and lime, all were grass or small grain-clover combinations, and none were grazed below 3" top growth, nor grazed when the ground was soggy. These may well become 5 'MUSTS', for most successful production of winter grazing pastures made up of the winter annual types of pasture plants."

Methods of Seedbed Preparation for Wheat Production - Harley A. Daniel, Guthrie, Oklahoma.-"Several methods of plowing for wheat production are being studied on the Wheatland Station at Cherokee. These different kinds of cultivation for seedbed preparation are conducted under two general types of tillage--continuous and rotated.

"The highest average yield of wheat to date from the continuous tillage tests has been produced on the plowed land. Yields have been lowest on the stubble mulch plots. The average yields on the listed and basin listed land have been the same, and they are only slightly less than on the plowed land. The mulched plots have consistently contained a heavy growth of cheat and weeds, and the wheat plants have been attacked by an infestation of foot rot each season beginning with 1944. During 1943 some straw worm damage was also observed on the mulched plots.

Effect of Different Methods of Continuous Tillage on Yields of Wheat at Cherokee, Oklahoma

Method of Tillage	Yield of Wheat Per Acre(1)	
	Grain (Bushels)	Straw (Tons)
Plowed	19.4	1.45
Basin listed	18.8	1.39
Listed	18.7	1.37
Stubble mulch	15.0	1.16

(1) Seven-year average 1942-48. Precipitation average 24.5 inches.

"The highest average yield to date from the annually rotated tillage areas has been produced on the oneway plowed land and the lowest on the stubble mulch. The water loss in runoff was the highest from the oneway plowed land. Where the tillage methods were rotated, weeds, foot rot, etc., have not been a serious problem.

Effect of Different Methods of Rotated Tillage on Wheat Yields and Runoff Water; Cherokee, Oklahoma (1)

Method of Tillage(2)	Yield of Wheat Per Acre (3)		Percent Runoff(4)
	Grain (Bushels)	Straw (Tons)	
One-way plowed	19.5	1.44	11.6
Basin listed	18.8	1.40	8.5
Stubble mulch	17.5	1.26	9.5

(1)For crop-year (7/1-6/30). (2)Cultivated on contour. (3) Average of seven years 1942-48. (4) Average of six years 1943-48.

Silt Removal from Grassed Terrace Channels-"A very careful study was made of the conditions of the water channels on the Wheatland Station at Cherokee. Due to the heavy snows in January and February and the extra amount of moisture and runoff, much silt moved into some of these channels. In many places they were practically filled with silt deposits. After considerable thought and study, the badly silted areas were cultivated with a spring-tooth harrow. This treatment proved quite successful. The rain of March 25 was of sufficient intensity to cause a high rate of runoff and much of this silt was moved on out of the channels, bringing the grade back to the original grass.

"In the Spring of 1947 several gullies on the Red Plains Station were worked down with a farm tractor and bulldozed. They were then fertilized with 150 pounds of superphosphate per acre and seeded to biennial sweet clover. The sweet clover in these gullies produced an average of 4,520 pounds of forage and 234 pounds of seed per acre in 1948. Many of these gullies were from four to ten feet deep before the work was started. This area is now being prepared for the seeding of the King Ranch strain of Yellow Bluestem."

Kudzu Spacing Study - E. C. Richardson, Auburn, Alabama.-"In early 1946, a kudzu planting was made at North Auburn for the purpose of studying the effect of different spacing of plants on the rapidity of developing cover. Rows were spaced 4, 8, 16, and 24 feet apart. Home dug crowns, uniform in size, were spaced 3-1/2 feet in the drill for all row spacings.

"Superphosphate was applied to the plants at a constant rate per acre and at a constant rate per plant. At a constant rate per acre, the concentration of superphosphate applied to the plants in rows 24 feet apart was approximately 6 times as great as that applied to plants in rows spaced four feet apart.

"When superphosphate was applied at a constant rate per plant, a higher rate per acre occurred where the plants were spaced 4 feet apart than in wider row spacings.

"All of the fertilizer was applied at the time of planting. It was distributed in an open furrow adjacent to the plants and covered.

"Each year, in late summer, a study has been made to determine the amount of cover produced under the different spacings and fertilizer treatments. In March 1949, a crown study was made for the purpose of determining the number of kudzu crowns developed in the different treatments. Areas one square yard in size were excavated on the row and in the middles, and crowns were removed, counted, weighed, and calculated to a per acre basis. Results of this stuby are shown in the following table.

Number of kudzu plants per acre and weight of plants in kudzu spacing study. Plantings were made in March 1946. Kudzu crown study was made in March 1949

Spacing		No. Plants per acre			Weight of Plants per acre		
Row	Drill	Row	Middle	Average	Row	Middle	Ave.
ft.	ft.				lb.	lb.	lb.
		Fertilizer per acre constant					
4	3-1/2	65,340	78,650	71,995	11,495	6,655	9,075
8	"	70,986	95,993	83,489	7,663	6,453	7,058
16	"	78,045	55,055	66,550	15,125	5,748	10,436
24	"	52,433	35,816	44,124	9,438	5,082	7,260
		Fertilizer per plant constant					
4	"	61,710	72,600	67,155	8,470	6,050	7,260
8	"	71,793	61,306	66,549	10,083	5,243	7,663
16	"	66,953	39,526	53,239	10,486	3,630	7,058
24	"	66,953	49,206	58,079	8,873	4,033	6,453

"Based on studies of other areas considered to be fully developed, the area had approximately three-fourths of a full stand of plants. Where rows were spaced 4 and 8 feet apart, the concentration of plants in the middle averaged a little higher in number than the concentration along the row. In the wider row spacings, the concentration of plants along the row was greater than that of the middle. In all cases the plants along the rows were larger than those in the middle."

Tropical Kudzu Spread by Oxen - R. M. Smith, Mayaguez, Puerto Rico.-"It has been interesting to observe that tropical kudzu seed has germinated abundantly in the droppings of work oxen in this native pasture and the seedlings are growing vigorously. The same has been observed in the dairy pastures. This indicates that the kudzu seed are well scarified by passing through animals, and that the proper alternation of grazing between kudzu areas in seed and unimproved pasture, would provide an excellent means for spreading this valuable legume.

Tobacco Land Studies-"Mr. Telford has summarized in Table 1 some of the soils information which we have been accumulating for the Utuado crop rotation plots. The analyses have been carried out by Mr. Cernuda. Tobacco yields and soil losses recently measured by Mr. Telford on the rotation plots and on constructed terraces are shown in Table 2. Two adjacent farmer plots selected for yield comparison are also included.

"Trashy culture has obviously decreased erosion losses, but it does not yet appear to be very promising as a practical method of growing tobacco in the area. Gravity movement of loosened surface soil down these steep slopes is difficult to control by any means except slope reduction. We have explained this point and its probable implications in a recent memorandum to all cooperators of our project, in the hope of obtaining helpful suggestions on the subject. The situation is forcefully illustrated by our recent observation that I caused more soil loss by walking across a bare plot to collect a composite soil sample than was caused by an intense 2-inch rain of the previous day.

"The tobacco yields obtained on the trashy plots are not significantly lower than on the clean tilled plots, but the plants appeared to be somewhat stunted from a lack of nitrogen at certain stages of growth. There is a suggestion of this in the smaller average leaf size on the trashy plots. Cultivation was considered to be much more difficult with the trash than without. It is hoped that heavy legume residues (velvet bean or kudzu) will provide better soil protection, will help to balance the nitrogen supply, and make cultivation easier.

"Mr. Telford has placed tobacco samples in an Utuado warehouse for curing so that an accurate evaluation of quality may be obtained.

"It appears from tables 1 and 2 that moisture deficiency may have limited tobacco growth; although there are no close relations between individual plot yields and obvious soil or moisture conditions. Extreme conditions in farmers' fields have an obvious effect on yields. The light colored, shallow 'tosca' points almost always support very poor growth.

"The yields obtained on the three constructed terraces show what can be done starting with fresh subsoil material. It is evident that the subsoil needs to be improved but that it is not hopeless.

"There is no evidence as yet that the potash in farmers' fertilizer is needed in this area. Our yields without potash are at least equal to the farmers' best. Of course, some difference in quality or in future yields may be found.

Table 1.--General soils information for the experimental crop rotation plots in the Utuado Area.

Plot No.	pH		Total Bases m.e./100 gms.		Soluble P in ppm		Percent Org. Matter		Plot Surface Exposure	Soil Characteristics Observed
	0-6"	10-12"	0-6"	10-12"	0-6"	10-12"	0-6"	10-12"		
1a	5.1	5.4	15.6	14.1	7	2	2.41	2.16	Northwest	Moist Utuado Loam
2a	5.35	5.4	21.5	16.0	66	3	4.19	2.26	Southeast	Dry rocky ridge
3a	4.7	5.55	18.8	14.1	87	26	1.70	.46	East	"
4a	4.35	5.35	21.3	24.3	13	6	3.71	2.55	South	Dry Utuado Loam
5a	4.85	5.25	17.8	20.5	35	2	3.28	2.00	North	Moist Utuado Loam
6a	5.45	5.60	30.0	30.7	56	104	2.98	1.21	Southeast	Dry Utuado Loam
7a	5.10	5.55	28.1	34.5	40	187	2.91	.58	Northwest	Moist Utuado & Jayuya Loam
8a	5.45	5.75	30.3	32.6	40	259	2.88	.63	East	Dry steep rocky ridge
9a	5.43	5.47	28.1	25.5	22	61	2.78	1.36	Northwest	Moist shallow soil
10a	5.32	5.30	25.1	16.0	17	6	3.96	2.19	Southeast	Dry shallow soil
1b	4.80	5.12	15.0	11.5	Trace	3	2.66	2.17	Northwest	Moist Utuado & Jayuya Loam
2b	5.00	5.22	10.9	17.3	2	Trace	3.44	1.38	Northeast	Moist shallow Utuado Loam
3b	5.05	5.25	11.9	17.5	3	Trace	3.20	1.53	Northwest	Moist Utuado Loam
4b	4.95	5.67	16.9	30.3	8	Trace	2.86	1.05	North	Moist Utuado Loam
5b	5.30	5.5	28.7	37.1	2	22	2.03	.53	East	Dry shallow Utuado Loam
6b	5.15	5.15	21.3	19.5	24	9	1.65	1.63	Southeast	Dry shallow Utuado Loam
7b	5.1	5.2	20.6	24.9	20	60	3.10	1.03	Northwest	Dry, irregular Utuado&Jayuya
8b	5.27	5.3	27.8	30.1	8	4	3.15	1.27	West	"
9b	5.5	5.45	21.9	12.1	13	2	3.61	1.76	East	Moist Utuado Loam
10b	5.45	5.5	25.0	18.5	43	23	4.49	2.05	East	Moist Utuado Loam

Table 2.--Tobacco yields and soil losses in the Utuado, Puerto Rico Area for the 1948-1949 season. (Oct., 1948 to March 10, 1949).

Plot No.	Treatments	No. of Leaves Harvested per acre	Tobacco Yield in Lbs./acre	Soil Loss in Tons/Acre	Remarks
1a	Clean tilled followed by	166,000	2585	24.3	
7a	corn and beans. Fertilizer applied	142,000	811*	10.8	Shallow rocky soil.
6b	1000 lbs./acre of 10-10-0	193,000	1838	12.2	
9b		178,000	1432	17.5	
	Average	169,750	1666	16.2	
5a	Trashy culture** followed by	209,000	1967	8.1	
10a	corn. Fertilized	197,000	1462	6.7	
2b	same as above	192,000	1335	4.0	
5b		188,000	1076	8.1	Steep rocky point.
	Average	196,500	1460	6.7	
3a	Clean tilled followed by	179,000	2000	31.0	
8a	sweet potatoes. Fertilized	176,000	930	16.2	Thin surface soil.
1b	same as above.	203,000	2232	17.5	
7b		166,000	1631	16.2	
	Average	181,000	1698	20.2	
F3	Treated with 1000 lbs./A 7-8-10	131,000	935	-	Farmer's plot below plots 7a and 8a
F4	Same as above	161,000	1579	-	Best farmer's plot near 10a
T1	Treated with 15 tons per acre cachaza 1500 lbs/A 10-10-0	82,500	851	1 ton estimated	1st Terrace - Barrier plants not stable.
T2	1000 lbs./A 7-8-10	89,500	639	very little	2nd Terrace - 1/2 barrier plants good.
T3	2000 lbs./A 10-10-0 and 20 tons/A manure	98,500	1000	none	3rd Terrace - Barrier well stabilized by bucare hedge with frame.

* Nitrogen applied 60 days late.
** Mixed dead and living native plant material left between tobacco rows.

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"Of the 3.42 inches of rainfall for the month, 90 percent or more was absorbed into the soil. Well-drained grass and woodland absorbed almost all of the rainfall - there was less than 0.002 inch of runoff. Slowly permeable grassland yielded as much as 0.18 inch of runoff. Runoff and erosion from wheat watersheds is given below:

Watershed treatment	Runoff for the month: Max. peak	Runoff for the month: Amount	Soil loss
	Inches per hour	Inches	Pounds per acre
Wheat, w/o manure top dressing	0.39	0.40	559
Wheat, w/manure top dressing	.16	.08	113

"Soils in mulch cornland have a higher coefficient of aggregation than those in plowed cornland as shown below:

Aggregate analysis of 0-1", 1-4", and 4-7" soil depths on corn strips sampled 9-24-48. Field 45

Tillage	Weed control	Total aggregates % > .2 mm. 0-1"	1-4"	4-7"	Coefficient of aggregation 0-1"	1-4"	4-7"
Plowed	2,4-D	26.8	30.3	29.2	378	377	396
Plowed	Cultivation	17.6	24.9	27.2	355	406	475
Plowed without moldboard	2,4-D	36.4	38.2	36.4	552	537	546
-do-	Cultivation	33.8	37.9	37.9	453	449	503

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-"During March, 1.76 inches of precipitation was measured at the Meteorological Station, which is about three-quarters of an inch above the 51-year average for the month.

"Soil moisture conditions are quite unusual this spring. Nearly all the winter precipitation fell in the form of snow, which in general was accompanied by wind. The snow was blown from the sparsely covered fields and

lodged in the corn fields, along tree strips, fence lines, and other obstructions. Moisture in the corn fields appears to be above normal, however, our soil moisture samples show there was less moisture in the meadow and grain stubble the last of March this year, than in the past 4 years. The following table shows the relationship of the past 5 years soil moisture for the last of March:

Soil Moisture

Date	Total Inches of Water			
	Cultivated - Grain Stubble		Meadow	
	Top 1 Foot In/water	Top 3 Feet In/water	Top 1 Foot In/water	Top 3 Feet In/water
Mar. 20, 1945	4.02	11.2	5.10	13.3
Mar. 20, 1946	4.18	9.81	5.25	11.4
Mar. 20, 1947	5.21	12.6	5.79	13.7
Mar. 30, 1948	3.89	9.91	4.87	10.7
Mar. 23, 1949	3.30	8.34	4.45	8.78

"Considerable progress was made toward placing watershed W-5 containing 411 acres, under a conservation program. Several meetings with SCS personnel were held, including an inspection of the area. All the farmers, except one were contacted and they are willing to sign a dollar a year agreement giving us control of their land. Operations personnel, from the Regional SCS, down to the Work-Unit Leader, can be commended for their splendid cooperation with Research in making this program possible. In addition to the runoff information, which will be obtained in comparing a large treated watershed against an untreated watershed we hope to obtain some valuable and much needed information on grassed waterways. This information is vital to Operations."

Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.-"As stated in our earlier reports, we have had an unusual amount of winter and early spring runoff this year. The runoff data for the more important storms are summarized in the following table.

"Preliminary examination of these winter and early spring runoff data indicates:

1. Similar, high water losses from wheat, 1st year and 2nd year meadow.
2. Little effect of the conservation treatment on the total water losses.
3. Greater effect of treatment and crops on peak runoff rates than on the total runoff.

"The soil and fertility loss data have not been compiled; but from observation of the relative density of the samples when collected it is obvious that the erosion losses from the wheat watersheds were quite high and much greater than from either the old or new meadows. It is also anticipated that the treatment will be found to have had much greater effect on the erosion than on the water losses.

Table 1.--Runoff summary data, four 1949 winter and early spring storms Purdue-Throckmorton Farm, Lafayette, Indiana

(2 Watersheds Each, Listed Respectively)

Crop	Treatment	Runoff: Total, % of rainfall	Runoff: Peak rate in./hr.
	Jan. 18, Total Rainfall = 2.13 in. Max. Rain Intensities: 5 min. = 0.60 in./hr. 10 min. = 0.54 in./hr. 15 min. = 0.44 in./hr.		
Wheat	Prevailing	18.8 & 51.2	0.18 & 0.28
	Conservation	34.3 & 26.7	.26 & .17
New Meadow	Prevailing	65.3 & 12.6	.26 & .12
	Conservation	39.4 & 0.00	.18 & .00
Old Meadow	Prevailing	39.4 & 17.8	.17 & .09
	Conservation	31.9 & 31.0	.13 & .16
	Jan. 27, Total Rainfall = 0.83 in. Max. Intensities: 5 min. = 0.96 in./hr. 10 min. = 0.60 in./hr. 15 min. = 0.44 in./hr.		
Wheat	Prevailing	37.4 & 90.3	.23 & .22
	Conservation	16.2 & 26.5	.14 & .10
New Meadow	Prevailing	81.0 & 60.3	.15 & .14
	Conservation	40.5 & 1.9	.08 & .02
Old Meadow	Prevailing	30.1 & 32.8	.06 & .08
	Conservation	43.4 & 62.6	.09 & .11
	Feb. 14, Total Rainfall = 2.02 in. Max. Intensities: 5 min. = 1.44 in./hr. 10 min. = 1.26 in./hr. 15 min. = 1.08 in./hr.		
Wheat	Prevailing	36.2 & 67.8	.83 & .80
	Conservation	40.9 & 21.8	.47 & .36
New Meadow	Prevailing	36.1 & 46.1	.28 & .41
	Conservation	28.2 & 14.7	.21 & .45
Old Meadow	Prevailing	37.1 & 42.1	.31 & .30
	Conservation	36.1 & 39.7	.22 & .22
	Mar. 26, Total Rainfall = 0.72 in. Max. Intensities: 5 min. = 1.82 in./hr. 10 min. = 1.43 in./hr. 15 min. = 1.32 in./hr.		
Wheat	Prevailing	16.8 & 28.8	.52 & .16
	Conservation	23.5 & 8.2	.56 & .10
New Meadow	Prevailing	40.9 & 40.4	.34 & .22
	Conservation	30.2 & 00.0	.21 & .00
Old Meadow	Prevailing	33.2 & 17.2	.18 & .12
	Conservation	27.6 & 36.3	.15 & .09

Hydrologic Studies - G. A. Crabb, Jr., East Lansing, Michigan.- "Precipitation for the month of March, as measured by the U. S. Weather Bureau type of non-recording rain gage, amounted to 2.65 inches at the cultivated watersheds, 2.28 inches at the wooded watersheds, and 2.72 inches at the stubble-mulch plots. These amounts are approximately 113 percent, 97 percent, and 116 percent of the 2.35-inch normal March rainfall for East Lansing. Precipitation for the month of March at the cultivated watersheds can be expected to equal or exceed 2.35 inches once in 2.0 years, according to the frequency curves prepared from the 1864-1947 precipitation records. It rained eight times and snowed five times during the month. Temperatures during the month varied rather widely, and the combination of precipitation and snow-melt produced seven runoffs, as follows:

Watershed	Date	Amount of Precipitation	Amount of Runoff
A	3/ 4/49	0	0.1049
A	3/ 5/49	.05	T
A	3/22/49	.43	.0374
B	3/ 4/49	0	.0797
B	3/22/49	.43	.0607
B	3/31/49	1.41	.0539
B	3/31/49	1.41	.0943

"During the month, further conferences were held with representatives of the U. S. Weather Bureau and Operation of SCS, resulting in definite plans for a cooperation between the two agencies and Research of SCS in a flood prediction study in the Saginaw River Basin. Basically, the study will be as follows: SCS Operations personnel located in key spots in the Saginaw River Basin will make snow surveys at weekly intervals, and following snowfall. They will also keep precipitation records. These reports will be mailed to the Michigan State Office, U. S. Weather Bureau, at intervals. In addition, reports following every snowfall and 1/2-inch or more rain will be radioed to the U. S. Weather Bureau via State Conservation Department radio immediately following such precipitation. All surveys and observations will be made in accordance with procedure outlines prepared by SCS Research. The U. S. Weather Bureau will base local flood forecasts on these reports for their daily radio programs. On March 28, in company with Mr. A. H. Eichmier, Senior Meteorologist, U. S. Weather Bureau, Michigan State Section, the Project Supervisor located snow courses and observation stations and instructed personnel in operational procedure, adjacent to Evart, Clare, and Lapeer, Mich. It is felt that this type of study will be of exceptional value to the landowners in the Saginaw River Basin and will provide an opportunity for both Services to more adequately use data readily available to them."

Hydrologic Studies - R. W. Baird, Waco, Texas.-"Precipitation for the month of March totaled 2.55 inches. This compares with a normal for March of 2.96 inches. Rainfall for the first 3 months of 1949 is slightly above normal due largely to the 4 inches of rain received in January. The rains of March caused only a small amount of runoff from some of the field areas without conservation practices and from roads, farmsteads, and other impervious areas. Practically no runoff was measured from the Y area on which conservation practices have been established.

"There continues to be a deficiency of soil moisture at depths of 5 feet or greater. Our present sampling procedure to a depth of 5 feet indicates some dry soil above the 5-foot depth. There is sufficient moisture for spring growth of crops, but there is no reserve for the summer period. As April and May are normally months of heavy rainfall, there is still a good opportunity for a good crop in 1949.

"Work on the tabulation and computation of runoff records has been continued and some work done on analysis. A preliminary study has been made for station Y (300 acres) in the comparison of this station against the area W-1 (176 acres). In spite of a limited number of storms available for this study, significant results appear to have been obtained. The effect of conservation practices on the Y area appears to reduce the peak rate of runoff about 0.70 inch per hour as compared with the area without conservation practices. This effect is somewhat greater than for the Y-2 area (130 acres) on which more data are available. However, the general effect for the two areas seems to fit in with anticipated results, the greater effect on the 300-acre area probably being due to the longer terraces in the headwaters of one of the tributary streams. This indicates that a more detailed study of the conservation system in effect might enable us to make a closer estimate of the effect of our conservation practices on peak rates of runoff. Work is being continued on these analyses as well as on analyses of areas of other sizes."

Farm Ponds - T. W. Edminster, Blacksburg, Virginia.-Mr. Holtan, Project Leader on the Farm Pond Sealing Studies, makes the following report:

"Sedimentation curves are now on hand for all twelve soils covering three conditions of the soil in farm pond sealing studies: aggregated, dispersed, and aggregated plus bentonite needed to seal a 5-inch column versus 30 feet of water.

"Analyses of these data using the units of 'density of suspension' at various times from start indicates several features. Time was plotted as a logarithm.

1. The curves of the aggregated soil suspensions versus time are of inconsistent curvature but are all concave upward (density scale) on

semi-logarithmic paper. The intercept or position on the density scale also varies between soils.

2. Curves of dispersed soil suspensions have logically greater intercepts (density) than do the aggregated soil suspensions. These curves, however, are either straight lines on semi-logarithmic coordinates or are concave downward. The one exception to this is the sandy loam (70 percent sand).

3. The curves of aggregated soils successfully treated with bentonite to seal versus 30 feet of water are good conformants to a straight line on semi-logarithmic plottings. That is, they fit the equation:

$$D_S = m \log T + A$$

Where:

D_S = density of suspension

m = slope
T = Time
A = Intercept or D_S at T = 1

"These curves lie above the aggregate curve but below the dispersed curve. They have a slight tendency toward downward concavity but not as accented as the dispersed soil. The change of shape implies that some dispersion resulted, from the bentonite, as well as some addition of clay size.

4. Check runs indicate that the shape, curvature, or slope of these curves is constant but new samples of the same soil may give different intercepts, i.e., a different position on the density scale. This condition invalidates any quantitative analyses of these data concerning amount of clay, silt, or sand, gone into aggregation, etc.

"It is planned that 400 + grams of soil be thoroughly mixed and prepared for the sedimentation tests. This would be divided into 4 samples of 100 grams each (A, B, C, and D). Aggregate sedimentation tests would be run on all four. A and B would then be dispersed thoroughly and tested for dispersed sedimentation. C and D would be decanted or dried down to a point where bentonite could be worked into the soil to form a paste. (The amount of bentonite would equal that previously found to seal vs. 30' head.) C and D would then be tested for aggregate plus bentonite sedimentation.

"After repeating this procedure for each soil, we should have basic data for quantitative analyses. We should be able to isolate such factors as work done by bentonite, clay, silt or sand gone into aggregation, etc. since the identical same soil is used for aggregate and dispersed sedimentation and also the same soil for aggregate and bentonite treated sedimentation tests.

"Sufficient transparent plexiglass is on hand to fabricate two sedimentation tube units. One such unit is almost complete at this writing. Mrs. Johnson, Laboratory Assistant to Mr. Moody, having had previous experience with plastics, is doing the assembly of these units. With this transparent material, the operator will be able to visually check such items as surface level of suspension, plugging of tangent tube lower end by sediment, air bubbles in tangent tube, etc."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minn.-"Studies were conducted during the month for several different structures for use in the drainage system at the Whiting Field Naval Air Station located near Milton, Florida.

"The tests of the pipe outlet structure designated O-4 were begun during the month. The tailwater at this structure depends on the design adopted for the channel junction structure P-9, and a tentative method for the design of the junction had to be worked out and agreed on before the tests on pipe outlet structure O-4 could be initiated. For this reason the tests have been delayed somewhat. The initial tests have shown that the chute entering the structure from one side causes poor flow distribution and waves in the downstream channel. Efforts are now being directed toward the elimination of this difficulty.

"Mr. Bowers conducted studies for the terrace outlets entering A and W from the top. This design consists of a box or flume transverse to and above the main channel. The flow enters the flume and turns through 90°, dropping over a weir onto the surface of the water flowing down the main channel. The studies were conducted for a discharge of 400 cfs in the main channel and 25 cfs in the lateral channel. The Froude number in the main channel was in the vicinity of 15. Flow conditions were good.

"The same side weir design was tested for structures P-10 and P-11. At each of these laterals the flow is 70 cfs. The Froude number in P ditch is quite low at these locations and the flow conditions were unsatisfactory. Means for the correction of this unsatisfactory condition are now being considered."

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma.-"A preliminary analysis of some of the low flow studies has been started. Dimensionless coefficients of friction have been plotted against corresponding values of Reynold's number. This dimensionless coefficient is equal to $2g/c^2$, where C is Chezy's C. Keulegan designates it as lambda, λ. This method of plotting the data has proved to be much more sensitive than using Manning's n. For the very low flows, Reynolds number 1,000 or less, λ appears to be a function of Reynold's number. For larger values of Reynold's number λ seems to be independent of this number. The point of change ranges from Reynold's numbers between 300 and 6,000. The data

seem to be neither consistent nor conclusive. Apparently the amount of debris on the channel bed has large influence. This has not been carefully measured since it was not of great importance in the channel studies of which these data are a part. There seems to be great interest in the low flow studies. Irrigators concerned with border method irrigation over sod crops as well as drainage engineers are interested."

Drainage Studies - M. H. Gallatin, Homestead, Florida.-"Average rainfall for the area for this period has been about the same as for the past two years. Normally rainfall in March is quite low. The following are the records of our rainfall for the various gages throughout the area.

Location-Gage	March 1949	March 1948	March 1947
Redland, Mowry	.50	.53	1.21
Sub-Tropical	1.63	.18	1.24
Redland, Gossman	.53	1.00	1.26
Plummer, Comfort	.73		
Peters, Florida	3.05	.99	.69
Princeton	1.25	.43	.70
Cooper	1.20	2.92	.80
W. Mowry	.55	.20	1.00
E-33	.70	.66	.44
Roberts, Avocado	.76	.29	1.34
Jeran	1.59		

"Water tables have fallen rather rapidly during this period. For the Redland Profile the loss ranged from 0.53 foot at E-33 at Highlands, to 1.77 feet at the measuring point on Gossman. A minus water table was recorded for E-33 located at the Highlands water control plot on 4/4/49. Without a doubt the water table for the greater portion of the marl land has a minus water table.

"Losses for the Mowry Street profile ranged from 0.88 foot at Well #26 at the western end of the profile to 0.52 foot in the East Glades area.

"For the Eureka profile losses ranged from 0.19 foot at Peters to 1.04 feet at Well #17 (1/2 mile east of Krome Road). It will be noted that the loss in water table was not as great at the east end of the Eureka profile. This was due to a heavy rain of 2 - 3 inches which occurred February 20 in this area, while for the rest of the area the rainfall was comparatively light.

"Daily reading at Well #5 show that the water table there was the lowest for this date so far recorded since this study was initiated. On March 31, 1949, the water table was 0.71 foot M.S.L. March 31, 1948, it was 1.33 feet M.S.L. and March 31, 1947, 1.05 feet. March 31, 1946, was 1.57 feet M.S.L. Our water table is somewhat lower this year than it has been for several years.

"During this period of low rainfall and extremely low water tables throughout the area our readings on irrigated areas show that to maintain the moisture content above the wilting point the irrigation cycle (application 1 acre-inch) must be maintained at a 6-7 day cycle. We have found that heavier applications do not increase the cycle. In one instance 2 inches were applied of the same moisture content as the area which had received 1 inch of water.

"In connection with the nitrate leaching studies, results obtained during this period follow those of the past month. It has been noted that when such fertilizers containing large portions of $(NH_4)_2SO_4$ or Urea are used the losses are high even though no rain has occurred. There is little doubt that we are losing NH_3.

"Along with our study of leaching of nitrates the Station personnel have been carrying on a study covering phosphorus and potash. Indications to date, though this study has only been carried on 8-9 months, are that phosphorus is tied up very quickly after application. This study carried on young and mature groves indicates that this process continues until the surface layer has been saturated. This process, from the findings to date, takes 8-10 years depending upon the methods of application and amounts applied.

"Studies to date on potassium indicate that it is lost quite rapidly, at about the same rate as nitrogen.

"Samples collected in the Homestead area show that there has been a general increase in the concentration of chlorides with a much greater increase in the area east of Allapatta Road to the structure in the Military Canal. Perpendicular lines were run north and south over this area and it was found that this area 1/4-mile either side, was heavily contaminated. For some time it has been thought that the heavy pumping at the Military installation at the west end of the Military Canal was the cause of this increase. Further investigation into this shows that both of these areas north and south of the Canal were pumped early this year. Pumping was done from dry rock ditches. Indications are that this heavy pumping from these ditches which penetrate the permeable rock lowered the fresh water head allowing the salt wedge to move in. One of the farmers indicated that production had been cut in half in this area.

"Samples collected in the Miami area show that there has been a definite rise in the concentration of chlorides."

Drainage Studies - J. C. Stephens, West Palm Beach, Florida.- "General rainfall over the northern Everglades for the month of March was subnormal and the drought which began about November 1 of 1948 continued.

"During March at the Everglades Experiment Station rainfall amounted to 0.37 inch; evaporation from the standard pan was 6.005 inches.

"During the month considerable time was spent on consulting or cooperative work with the Everglades Drainage District. This included a study and review of permeability data obtained from the Osborne Grove studies and data obtained from the U. S. Geological Survey on drilled wells and computed seepage along the Dade-Broward and Golden Glades levies, in Dade County during the high water for the past two years.

"From pumping tests on drilled wells in Dade County near Snapper Creek Canal a coefficient of transmissibility of approximately 4,000,000 gallons a day, conducted laterally per mile for a 70 ft. deep water bearing bed (measured at right angles to the direction of percolation), with a hydraulic gradient of 1 ft. per mile, was computed by the Ground Water Section of the U. S. Geological Survey.

"An analysis of the hydrographs from the Tamiami-Miami canal basin which is protected from direct surface inflow by the Dade-Broward and Golden Glades levee system for a distance of about 25 lineal miles shows computed seepage inflow rates as follows:

Period	Computed seepage for period (Acre-feet)	Average seepage rate during period (Sec. ft.)	Average seepage rate per lineal mile of levee (Sec. ft. 1 mile)
	First Flood		
Dec. 1-Jan. 1,'47	155,000	2,500	100
Jan. 1-Feb. 1,'48	132,000	2,150	86
Feb. 1-Mar. 1,'48	95,000	1,700	68
	Second Flood		
Nov. 1-Dec. 1,'48	116,000	1,870	75
Dec. 1-Jan. 1,'49	111,000	1,795	72
Jan. 1-Feb. 1,'49	110,000	1,775	71

"From these and other data seepage flows along the South New River Canal were estimated and backwater curves prepared for the Drainage District to show the effect which removal of the dam at 15-mile dike would have on Canal stages in the Davie area."

Supplemental Irrigation Studies - James Turnbull, Lake Alfred, Florida.-"The severe drought in the Lake Alfred-Haines City section was broken on March 29 by a heavy local rain. The plots at Haines City received 3.15 inches of rain and the plots at Lake Alfred received 2.75 inches. This is the first rain of importance since December 9, 1948. The total rainfall between December 9 and March 29 was only 1.82 inches at Haines City and 2.07 inches at Lake Alfred. This, combined with an extremely warm winter, caused widespread wilting of non-irrigated groves.

"Irrigation of the plots at Haines City and Lake Alfred was delayed until danger from frost damage was slight. The Haines City plots were irrigated between February 24 and March 3, and the Lake Alfred plots were irrigated between March 4 and March 9. Irrigation of the Haines City plots had just been resumed on March 29 when the heavy rain broke the drought.

"The water stage recorder on Lake Confusion showed that the lake rose 3.48 inches in response to the 3.15 inches of rain occurring on its watershed. In view of the rapid rate at which the rain fell, and the extremely dry conditions of the soil, the runoff was considered very light. As has been pointed out previously this soil, when dry, is resistant to wetting and the greatest amount of runoff occurs when a heavy rain breaks a prolonged drought.

"The water table wells also responded to the rainfall, although theoretically there was insufficient rain to bring all the soil above the water table to field capacity. This adds evidence to support the theory that the water, either from irrigation or rainfall, funnels downward through wet or wettable channels."

Drainage Studies - T. W. Edminster, Blacksburg, Virginia.- Mr. Walter Turner, Soil Scientist, reports that soil permeability laboratory determinations were made for the following six sites:

Site Number	Soil Type
142	Applying sandy loam
143	Rankin fine sandy loam
144	Starr loam
145	Lenoir fine sandy loam
146	" " " "
147	Moyock fine sandy loam

On hand to be run are the cores for Site No. VA-148 of Moyock fine sandy loam.

He further reports a review of some of the Virginia permeability data was made with a statement in Baver's Soil Physics, 2nd. ed. p. 167, in mind. "The ideal soil should have the pore space about equally divided between large and small pores."

For the Piedmont soils of Sites VA-103 through 119 the rate of percolation was plotted as a function of water drained in 15 hours expressed in percentage of total porosity. The latter for a given rate increased from clay loam to sandy loam.

Apparently the best fit for a curve through the points for a given texture is a parabola with its focus and principal axis coinciding with the origin and the Y axis respectively. Apparently the "y" intercept decreases as the texture becomes lighter. The "x" intercept is apparently from 4 to 16 percent of the total porosity drained in 15 hours.

The data then were tabled according to the degree of permeability indicated by the rate of percolation. A summary of this table follows on page 31.

Summary of a table giving the ratio of field capacity to total porosity in percent and the corresponding rate of percolation for some piedmont soils for the several degrees of permeability

	SYMBOL OF DEGREE OF PERMEABILITY													
	1		2		3		4		5		6		7	
	%	in/hr	%	in/hr	%	in/hr	%	in/hr	%	in/hr	%	in/hr	%	in/hr.
Number of items	1	1	16	16	20	20	33	33	35	35	35	34	19	19
Average	4.8	.04	8.1	.11	16.1	.51	20.3	1.43	21.9	3.45	25.7	7.01	31.4	16.92
Standard Deviation			3.9	.04	4.0	.18	6.7	.44	9.1	.73	12.0	1.60	10.9	10.19
Coefficient of variation			48	38%	25	35%	33	31%	42	21%	47	23%	35	60%

Note: For all of the 158 pairs of items the coefficient of correlation is 0.43.

IRRIGATION DIVISION

Management of Related Irrigation and Drainage Enterprises, R-3-5-1 #3.-Mr. Maughan reports that field work in the Cub River Irrigation Company area during the past month has revealed a number of attitudes and opinions held by farmers of significance to possible improvements in irrigation and drainage organization. Many farmers are not satisfied with the multiple agencies set up to serve this area. There is a somewhat general feeling that the Cub River Irrigation Company which supplies water, partly to subsidiary distribution associations and partly directly to farmers, has not fully measured up to its opportunities for service to irrigators. Likewise the feeling is prevalent that irrigation is the main cause of the need for drainage and that the irrigation company has a responsibility which it has never assumed in connection therewith.

Many farmers recognize that the several small drainage districts have not the strength to properly deal with the drainage problem of the area in general.

There is no general agreement on how best to improve the irrigation and drainage organization. Farmers on the margins of the area, as a rule, are not sympathetic to organizational changes. In the sections where drainage problems are most acute farmers are asking for cooperation of their neighbors. Self-interest is the prime motive shaping farmer attitudes. To be acceptable, any further consolidation of interests must promise widely increased benefits through unified action.

Lining of Irrigation Canals and Ditches, R-3-2-3.-Mr. Lauritzen reports that a preliminary inspection of the experimental linings at Richmond and North Logan indicated all had come through the winter with little apparent deterioration.

The unprotected earth linings at the River Laboratory exhibit evidence of some slumping and erosion on the side slopes due to weathering. The gravel covered earth linings, on the other hand, appear to be in good condition. Considerable deterioration reflected in surface scaling and crumbling was found to be associated with the standard soil-cement and sodium silicate treated earth linings. A small amount of scaling of the plastic soil-cement lining was also observable. Rather extensive lateral cracking on the side slopes of the prime membrane could be observed, although cracking, if present in the buried membrane, was not pronounced. The appearance of the asphaltic concrete apparently was unchanged by the winter. A more detailed inspection of installations will be made soon. There has been no opportunity for making permeability measurements on the linings at the River Laboratory as yet and probably will not be for another month.

Snow Surveys, Idaho.-Mr. Criddle reports that the results of snow surveys made throughout Columbia Basin at the first of March indicate a snow pack far above normal in practically all parts of the Basin. The greatest snow depth in relation to normal is along the Cascades of Washington and Oregon. Here the snow pack is from one and one-half to two and one-half times normal. The possibility for heavy April-September runoff and high water stages is considerably greater now than a month ago over most of the Basin within the United States.

Drainage - Lower Rio Grande Valley, Texas - William W. Donnan, Los Angeles, Calif.-"One week was spent in the Lower Rio Grande Valley of Texas on a detail to assist Mr. Emil Stuter of our Weslaco, Texas office with drainage problems, and to confer with Operations personnel on drainage. An irrigated area of about 700,000 acres is partially affected by high ground waters and alkaline accumulations. A research program on drainage, similar to the one in progress in Imperial Valley, appears to be quite feasible. Various tools and techniques used in other irrigated areas of the West were demonstrated and tried out as to their adaptability to the Texas area conditions. An outline has been prepared of a tentative research program to fit into the irrigation research now in progress. At the conclusion of the week's field work a seminar was held with the joint Research and Operations staffs of the Lower Rio Grande Valley area in attendance."

Irrigation and Soil Moisture Investigations - Harry F. Blaney, Los Angeles, Calif.-"The report on 'Soil Moisture and Irrigation Practice Investigations' was revised for use by Operations. The following comparison of monthly transpiration use and consumptive use of water by oranges, peaches, walnuts and alfalfa shown in the following tabulation was added to the report:

Month	Transpiration use, inches			Consumptive use, inches		
	Orange 1/	Peaches 2/	Walnuts 3/	Oranges 1/	Peaches 2/	Alfalfa 3/
April	1.7	0.5	1.0	2.2	1.0	3.3
May	2.2	3.0	4.2	2.2	3.5	6.7
June	2.6	6.2	4.4	3.1	6.7	5.4
July	2.9	7.5	6.5	3.4	8.0	7.8
August	2.7	6.0	5.5	3.7	6.5	4.2
September	2.6	2.7	2.8	3.1	2.7	5.6
October	2.4	0.9	1.8	2.9	1.4	4.4
Total	17.1	26.8	26.2	20.6	29.8	37.4

1/ Los Angeles. 2/ San Bernardino County. 3/ Santa Ana."

Rainfall Disposal, Los Angeles West Coast - G. Marvin Litz, Los Angeles, Calif.-"After a series of spring rains culminating in a 1-inch storm on March 9, a third series of soil samples were taken at the various sampling sites in the West Coast Basin of Los Angeles. It was found that on the lighter soils particularly the Oakley sands the rainfall penetration was 4 to 5 feet. However, on the heavy soils rainfall this season has only penetrated about 20 inches. In all, 84 soil samples were secured and the moisture content in them has been determined. Unless additional rains fall to bring the season's precipitation up to normal, the rainfall penetration field studies for the second year in succession will have to be considered inconclusive."

Imperial Valley Progress Report - Harry F. Blaney, Los Angeles, Calif.-"The preparation of a preliminary 'Progress Report on Cooperative Investigations in Imperial Valley, California, for Year 1948', by William W. Donnan and George B. Bradshaw, was completed. This report presents the results of studies during 1948 on tile drainage systems, tile strength tests, hydraulic permeability, leaching, salinity, deep well drainage, Salton Sea evaporation, East Mesa Experimental Farms, ground-water observations on East Mesa, Pilot Knob Mesa and West Mesa, and artesian wells in Imperial Valley. The report consists of 61 pages of text and tables and 28 figures and plates. About 394 miles of tile were installed during 1948 on 17,220 acres of farm land. About 1,500 miles of tile have been installed on 82,370 acres during the past 20 years. In 1929 only 328 acres had been tiled."

Farm Leaching Study, Imperial Valley - George D. Bradshaw, Imperial, Calif.-"A field leaching study has been initiated on a 160-acre farm to determine the effect of intermittent leaching, alternately leaching and drying, over a period of 2 years. The soils are generally medium to heavy textured and will be slowly permeable. In November of 1948, 19,900 feet of clay tile was installed on the ranch with a lateral spacing of 337 feet and a tile depth of 6 feet. A series of 13 five-foot and two 20-foot soil samples were taken to determine the salt content before leaching. Replicate soil samples will be taken during the drying period to determine the rate of salt removal from the soil. A series of 5-, 10-, and 15-foot piezometers were also installed to determine the vertical movement of leach water. The water applied and the surface waste are being measured with 12-inch Parshall flumes. Surface evaporation is being measured with a 2-foot screen type pan. The flow from the tile drainage system is being measured at the outlet by a tile effluent recorder."

Irrigation Practice and Consumptive Use of Water in Central California Valleys - Lake County Investigation - Paul A. Ewing.-At a conference March 17 at Lakeport, agreement was reached as to procedure and responsibilities of the several agencies. Representatives of the State Division of Water Resources, SCS Operations, and SCS irrigation research were present.

The plan is essentially the same as that followed in the Salinas and Pajaro studies. The State Division of Water Resources is now completing its cultural survey of the valley areas, its map being in finished shape. The classifications used are those already standardized. SCS has mapped the areas above the valleys to the watershed crests, but not in strict conformity with our natural vegetation classifications. However, Mr. Bell's staff is intimately familiar with the terrain, and my impression is that they can adapt present watershed delineations to those we will want without much trouble. Mr. Blaney later indicated specifically what watershed classifications we propose to use. Not much land is in forest trees, the breakdown involving principally grass, light brush, and heavy brush.

As in the previous studies at Salinas and Watsonville, the Operations staff under Mr. Bell will select some 25 irrigated farms, trying to make them all around representative. We worked over the form of interview for the irrigation practice job. SCS Operations will handle this work, harmonizing it with the well-reading and other routine of the State men.

Mr. Blaney will probably have to visit the area again but this is not immediately necessary. I will return to Lakeport in a few weeks to advise on questions that may come up as the irrigation-practice field work gets under way.

Uncertainties developed in the previous Lakeport conference did not reappear, the session being completely harmonious and business-like. Mr. MacPartland represented the State. Wayne Austin accompanied me, and both Mr. Warnken and Mr. Enderlin came over from Sacramento.

I attended the monthly meeting of the Big Valley Soil Conservation District Board and found them greatly interested in the project and anxious to follow its progress.

Water Spreading for Storage Underground - A. T. Mitchelson, Dean C. Muckel, Hayden K. Rouse, E. S. Bliss, Curtis E. Johnson.-The Parshall flume at the headworks of the Upper Santa Ana River spreading near San Bernardino was visited twice during the month to check the recorder and pick up charts. Approximately 3,500 acre-feet have been spread so far this year (March 31, 1949) and the discharge on March 30 was 40 second-feet. This is expected to continue and possibly increase until the irrigation season begins.

The second phase of the Buffer Pond Experiment was ended on March 14 when the water supply was turned off and the ponds entered a drying out period. This phase began on September 20, 1948, when water was turned into both ponds simultaneously. After 29 days of operation, the supply of water for the outer pond was turned off to determine what effect this might have on the inner pond. After 52 more days, it seems that the rate in the inner pond was becoming stabilized at a point somewhat higher than previous runs had led us to expect. Water was turned on again in the outer pond

on December 10, 1948. Following this, the rate in the inner pond resumed its decline. It was noted that this decline was not continuous, but by steps, with the rate holding steady for a few days, then dropping for a few days after which the rate would again hold steady at a lower level. In view of this behavior, it is felt that the stabilized rate noted when the outer pond was dry may have been a part of this "step" process and not necessarily an effect of the drying of the outer pond. At the end of this phase, the rate of percolation had dropped to 0.11 foot per day. This compares with an initial rate of 4.25 feet per day and a maximum rate of 5.26 feet per day which occurred on the 10th day of this phase.

During the month the micro-organism population of the water in three recently flooded ponds was studied by frequent sampling. Two of these ponds are being run in parallel. Both of them had recent applications of 6 inches of gin trash, left on the surface in one pond and spaded under in the other. The third pond which was started this month also received a 6-inch application of gin trash spaded under in 1946. There seems to be no definite trends in the micro-organism population within the individual ponds which can be corrected with percolation rates. However, the pond containing the gin trash left on the surface has consistently shown higher numbers of micro-organisms than either of the other two which had the gin trash spaded under. These studies will be continued.

The Bureau of Reclamation is planning to furnish water from the Madera canal for release to natural channels for percolation to underground basins. They also hope to furnish water for the same purpose from the Friant-Kern canal to the Kaweah Delta channels along about July of this year. In studying some records of the San Joaquin Valley ground water supply, it develops that utilization of ground water for irrigation north of the Tehachapi did not become significant until after 1900. More or less complete direct diversion during the summer season of surface water supplies in South San Joaquin Valley prior to 1910 gave impetus to development of underground water there. The combined capacity of wells in the San Joaquin Valley south of Chowchilla was about 7,300 cubic feet per second by 1919 and about 20,600 cubic feet per second by 1929. Overdrafts on ground water occurred in much of the area prior to 1929 and have prevailed since that time. The combined gross pumpage of ground water from about 35,000 wells in the San Joaquin Valley south of Merced River during the seasonal year April 1, 1947 to April 1, 1948, is estimated at close to 6,000,000 acre-feet. In the Army Engineers' "Comprehensive Flood Control Survey Report 1945" it stated that the acreage served exclusively with irrigation water by pumping from underground supplies was 268,000 acres in the lower San Joaquin Valley and 715,000 acres in the upper valley. These acreages have increased since that report was issued.

R-3-3-1 - Snow Surveys and Irrigation Water Supply Forecasts - Homer J. Stockwell.-The March 1 snow reports for the Colorado, Missouri-Arkansas and Rio Grande drainage basins were issued on March 10. Practically all the mountain areas in Colorado, Wyoming and New Mexico had snow cover well in excess of normal. Heaviest snow cover was found on the North Platte, Rio Grande, San Juan and Dolores watersheds. April 1 snow surveys available at this time show that March snow accumulation was about normal. The probability of floods on these streams has diminished but it is still a possibility. For the Arkansas River, however, the runoff from snow will be normal or less.

We are trying to develop better correlations between antecedent hydrologic factors and subsequent runoff. Several students have been employed to assist in this work. We have been able to improve some of these relationships but the probable error in forecasting as of April 1 will remain rather large owing to the possibility of heavy late spring or early summer storms or the lack of them. By May 1 fairly accurate estimates can be made but large percentage errors may still be expected on the North and South Platte and Bighorn Rivers. Peak runoff studies as outlined by Messrs. Work and Garstka indicate that flood flows will not be likely this year if future snow accumulation is normal or less.

Irrigation Studies - Dean W. Bloodgood, Austin, Texas.-While on a trip to the Eagle Pass Area from March 5 to 11, I contacted the representatives of the Maverick County Water Control and Improvement District No. 1 and the Maverick County Soil Conservation District regarding proposed irrigation studies. The Soil Conservation District has mailed a written request to the Board of Water Engineers for assistance with these studies. Mr. Jack Keisling, one of our last year's cooperators at El Indio, chairman of the Soil Conservation District, and a member of the Water District Board (also chairman of A.A.A. Board), presented the request to the Board.

For this year's irrigation studies it was decided to concentrate on the work in smaller areas.

One of the areas selected will be at the Jack Keisling farm near El Indio. One of the units of the farm of about 75 acres (part of this farm - 150 acres - was used last year for irrigation studies) will be planted to cotton and watered by the ordinary present irrigation practice, while another 75-acre unit of the same farm (both units adjoining each other, same soil and climatic conditions and same operator) will be planted to cotton at the same time, but will be irrigated by the new "level irrigation" method being advocated by the Operations Division, SCS. The irrigation study on this farm should furnish good research data on the comparison of the two methods of irrigation for cotton.

The irrigation water for the "ordinary irrigation practice" field will be measured by a 9-inch Parshall flume (already installed) using about a 3-second foot head and flow recorder, while the water applied to the "level irrigation" field will be measured with a 3-foot concrete Parshall flume, using about a 10-second foot head. We furnish the forms, recorders, technical assistance, compilation of data, while the Districts furnish the concrete, labor, operation, etc. for the installation of the flumes.

Mr. Keisling, for the Soil Conservation District information, also desires to use the 3-foot flume (capable of measuring about 30 second-feet) to measure water to other farms (about 600 acres) which are below his farm but on the same lateral.

Mr. Keisling has prepared the one unit of his farm (75 acres) for "level irrigation" at a cost of about $60 an acre, which includes leveling, concrete checks, gates, pipe, etc. He made a statement to me that he doubts if either method of irrigation will save much water as regards total amount of water applied, but the "level irrigation" method (to his way of thinking) would provide a more uniform distribution of moisture and the yield per acre-inch of water applied should about double that for the ordinary irrigation practice.

Another farm of about 20 acres in the El Indio Area belonging to Sam Schwartz, President of Maverick County Water Control and Improvement District No. 1, was also selected for studying the "level irrigation" method of applying water for cotton. The soil on this farm is deeper and better than the soil on the Jack Keisling farm. A 1-foot concrete Parshall flume equipped with waterstage recorder will be used for measurement of water on his farm. A 10-second foot head of water will be used, as this amount is recommended by the Operations Division, SCS, for "level irrigation" method.

Another 98-acre unit which has been prepared for "level irrigation" on the old El Indio Ranch (El Indio Land Co.) was also selected to make a study of the comparison of the "level irrigation" and ordinary irrigation methods. Mr. E. F. Scales, manager of the ranch, is very much interested in these studies and has offered cooperation in every way possible. Both areas for the comparison studies will be under the same operator, same soil and climatic conditions, etc. The soil (alluvial) on this ranch is fairly uniform and ranges from 40 to 50 feet in depth (some of the best of the Rio Grande Valley), while the soil on the Keisling farm is on adjacent valley land and is shallow, ranging from 1 to 3 or 4 feet over a white marl. A 3-foot concrete Parshall flume will be installed for the measurement of water on the 98-acre "level irrigation" and the 1,000 acre "ordinary irrigation" tracts.

It will be necessary to have all of the water measuring devices installed prior to May 15th. There will be no runoff (surface drainage) water to measure from these farms.

In the Hopedale Area north of Eagle Pass, and where we attempted to obtain some water measurement data on about 1,100 acres of land last year, I selected the H. A.W. Frick 37-acre vegetable farm for this year's irrigation studies. Mr. Frick is one of the directors of the Water District and the newly organized Maverick County Soil Conservation District. He grows mostly cauliflower, broccoli, tomatoes, cabbage, turnips, beets, etc. for the Houston market. The soil is deep - from 30 to 40 feet - and uniform in texture. During the month we constructed wooden forms (cost $275, State funds) for the construction of concrete 9-inch Parshall flumes. A 9-inch Parshall flume will be installed at the Frick farm (cost to be borne by Water District) for the measurement of irrigation water. The Division of Irrigation will furnish waterstage recorders to be used in connection with the irrigation studies. All of the water applied to the vegetables will be used by them - no runoff. Mr. Frick is very cooperative and will give the studies his personal attention and supervision. A standard Weather Bureau type rain gage has been installed and a recording rain gage will be installed at the farm to be used in connection with the studies. The winter garden season was completed during the month. Vegetables are not grown in the Eagle Pass Area during the summer. The irrigation season for winter vegetables will commence about July 15 at which time we plan to have flume installation completed and be prepared for the winter vegetable irrigation season.

During the month a group of farmers in the Pecos Valley had a meeting at Imperial concerning the use of pumped well water that is being used for the irrigation of cotton. A member of the Board of Water Engineers attended this conference. The cotton growers and financial backers are becoming alarmed and concerned over the continued use of well water containing a high salt content for irrigation of cotton. It was suggested that the Board might undertake an irrigation study to determine the amount of salty water that could be safely used for the irrigation of cotton. At the present time the well water has produced good yields. Some of the farmers have offered to cooperate in donating land, water, labor, etc. if these studies could be undertaken.

The partial analysis in parts per million of irrigation water from some 59 to 66 wells located north of the West Lateral Canal near Imperial in Northern Pecos County, Texas, are as follows:

Depth of well - range from 14 to 158 feet (average, 97 feet)
Total dissolved solids - range from 6,830 to 13,100 (average 10,012)
Calcium - range from 424 to 896 (average 686)
Magnesium - range 242 to 528 (average 392)
Sodium and potassium - range 1,320 to 3,690 (average 2,244)
Bicarbonate - range 73 to 350 (average 207)
Sulfate - range 1,880 to 4,780 (average 2,987)
Chloride - range 2,300 to 5,150 (average 3,432)
Percent Sodium - range 48 to 65 (average 59.9)

The water used for irrigation purposes and for cotton in this area probably contains the highest amount of salts of any water used for the same purpose in the United States, if not in the world. The yield of this area for 1948 was 7,235 bales of cotton.

A map was prepared during the month of the proposed fields and water measuring installations which are to be used in connection with the proposed rice irrigation studies that might be undertaken at the Texas Agricultural Experiment Substation No. 4 at China near Beaumont. This map was prepared, reduced in size, and lithographed from an original map furnished by officials of the station. The map shows three fields that have been tentatively selected for these proposed studies. To measure the amount of water applied to these fields it will be necessary to install three Parshall flumes for measurement of water applied, and three flumes for measurement of water drained off the fields. Waterstage recorders will also be used in recording the water measurements.